

Notice of Allowability

Application No.

10/766,746

Examiner

Jennifer M. Dolan

Applicant(s)

WANG ET AL.

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Interview of 7/10/06.
2. ☒ The allowed claim(s) is/are 1-20.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 20060713.
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
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DETAILED ACTION

Examiner's Amendment

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with William Zahrt on 10 July 2006.

The application has been amended as follows:

In line 6 of claim 1, line 6 of claim 6, line 5 of claim 11, and line 6 of claim 6:

--thin-- has been added between "a" and "thermal interface"

In line 7 of claim 1 and line 6 of claim 11:

--the thermal interface material on-- has been inserted between "to" and "each semiconductor device"

In lines 8-12 of claim 1, lines 11-16 of claim 6, lines 7-11 of claim 11, and lines 10-15 of claim 16:

The phrase beginning with "all of the volume" and ending with "assembled on the substrate" has been replaced with --substantially all of the volume between the heat spreader and

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the substrate, except that occupied by the semiconductor devices and other electronic devices assembled on the substrate,--

2. Claims 1-20 are allowed.

3. The following is an examiner's statement of reasons for allowance:

The primary reason for allowance is the combination of attaching a heat spreader directly to the top of a semiconductor device, using an underfill, performing open encapsulation, and encapsulating all of the volume between the heat spreader panel and the substrate, thus necessitating the absence of a spacer or post system, in a strip-packaging process.

The prior art of record pertaining to packaging semiconductor devices in a continuous strip format generally indicates that excess pressure or stress applied to the top of the chip either while attaching the heat spreader or while encapsulating the device may cause the semiconductor device to crack. In order to prevent the cracking of the devices, the prior art teaches several methods different from that of the present invention. The first method includes use of spacer structures above (see US 6,734,552 to Combs et al.) or surrounding (US 6,933,176 to Kirloskar et al.) the devices to absorb stresses. Since the claim language specifically recites that the heat spreader is attached to the chip via a thin thermal interface material, and that all of the volume surrounding the chip is filled with encapsulant, the prior art methods using spacers do not read on the claims. Additionally, since the spacer elements in these prior art references are vital and necessary for stress alleviation, it is the Examiner's opinion the references teach away from elimination of such features.

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Alternatively, the prior art either uses non-open encapsulation methods (see US 6,830,956 to Masumoto et al. or US 6,444,498 to Huang et al.), which require significantly more complex fabrication steps, or the prior art teaches away from the use of an underfill (US 2004/0212056 to Chen et al.) by requiring flow of encapsulant material between the semiconductor device and the substrate in the encapsulation step in order to flow the encapsulant material across the continuous strip of devices. Since the prior art does not teach packaging of a continuous strip including all of the use of an underfill, the use of open encapsulation of the heat spreader panel, and the absence of spacer elements, it is the Examiner's opinion that the invention as claimed would not have been obvious to a person having ordinary skill in the art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jennifer M. Dolan
Examiner
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